

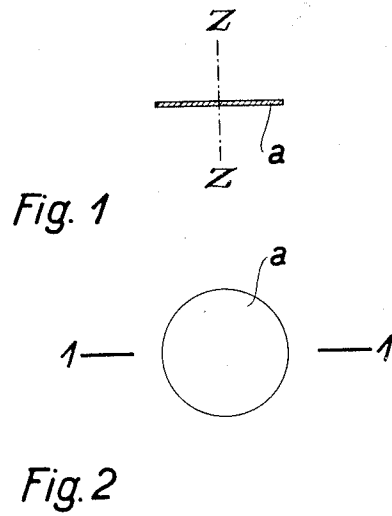
May 1, 1934.

H. STRAUBEL

1,957,299

PIEZO-ELECTRIC OSCILLATOR

Filed Aug. 26, 1931



Inventor:

Harold Straubel

UNITED STATES PATENT OFFICE

1,957,299

PIEZO-ELECTRIC OSCILLATOR

Harold Straubel, Jena, Germany, assignor to the
firm Carl Zeiss, Jena, Germany

Application August 26, 1931, Serial No. 559,424
In Germany April 1, 1931

2 Claims. (Cl. 171—327)

Exciting piezo-electric oscillators or resonators is effected by means of electron valves. The oscillator is generally disposed between the grid and the cathode of the valve and the requisite feed back is effected over the capacity between the grid and the anode. This feed back suffices for thin quartz oscillators (high frequencies) and comparatively low amplitudes. However, when longer waves (waves exceeding 400 meters), that is to say lower frequencies, are concerned, this kind of excitation is no longer of any avail. This disadvantage may be overcome by connecting several valves in parallel, which gives the curve a greater inclination. However, in most cases it is necessary to use an additional capacitive or inductive feed back either alone or in connection with this means, the consequence being that the oscillator is coupled more rigidly to the oscillation circuit of the anode. With stronger coupling the oscillator becomes more and more dependent on the working condition of the valve and on the frequency of the circuit of the anode and, therefore, the produced frequency is no longer determined by the dimensions of the oscillator and its physical properties alone.

A further disadvantage of the quartz oscillators is their damping. In order to maintain the state of oscillation, the oscillator is to be supplied a quantity of energy that corresponds to the damping, which quantity causes a heating and, consequently, no inconsiderable alteration of the frequency of the oscillator, even when the energy transmitted to the air is left out of account. For this reason an oscillator that is to be used as a frequency generator or indicator is required to have the least possible damping. In spite of their good qualities the quartz oscillators in use hitherto have a damping which, for the above mentioned reasons, is rather disturbing in many cases.

As the disadvantages inherent in the use of quartz are especially disturbing when wavelengths less than 40 meters are concerned, the present invention aims at using for particularly short waves an oscillator which is made of turmaline. The inventor has found out that an os-

cillator made of this material has a considerably inferior damping and therefore is highly superior to the quartz oscillator. The difference may be proved by the following example. When two oscillators, one of quartz and one of turmaline, the natural frequency of which was approximately 130 k. c. each, were supplied equal energies and voltages, the quartz oscillator arrived at its maximal amplitude of oscillation in an imperceptibly short time whereas it took the turmaline approximately one half second.

The most favorable conditions of oscillation were obtained by using as an oscillator a cylinder the axis of which was adjusted parallel or practically parallel to the optical axis of the turmaline. With oscillators of this kind the form of the cross section perpendicular to the cylinder axis has proved to be of nearly no moment whatever. Nearby frequencies (shaking of the disc) do not appear even when extremely short cylinders (thin discs) are used. Turmaline oscillators are therefore quite different from quartz oscillators of equal dimensions, which do not supply any uniform frequency. On the whole, turmaline has the tendency to effect shaking oscillations (nearby frequencies) in a much lesser degree than quartz.

The accompanying drawing illustrates on an enlarged scale an example of the invention in a cross section and in a view. Figures 1 and 2 represent a thin circular disc of turmaline *a*. In the example according to the drawing the optical axis *Z—Z* is perpendicular to the disc, however it may be more or less inclined to this disc. The oscillations take place in the direction of the optical axis.

I claim:

1. A piezo-electric oscillator or resonator being a disc of turmaline, the thickness of this disc being at most 0.25 mm.
2. A piezo-electric oscillator or resonator according to claim 1, the axis of this oscillator being substantially parallel to the optical axis.

HAROLD STRAUBEL.